Revision of the Genus *Pandanus* Stickman, Part 2
Pandanus in Western Australia and Notes on the Section Foullioya

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THIS IS THE SECOND PART of a revision of the genus *Pandanus*. The previous one was printed in *Pacific Science* 14(3): 224–241, 1960.

There have been earlier printed reports of *Pandanus* occurring in the state of Western Australia. These all identified the species as ones native to distant areas. The existing specimens from the region are meager, but by examining them in all of the principal Australian herbaria, it has been possible to learn enough of their structure to classify two of them. There are indications of a third species, but the two following are sufficiently known. As they appear to be novelties, they are here described as new species.

Pandanus kimberleyanus sp. nov. (sect. *Microstigma*)
Fig. 9

DIAGNOSIS HOLOTYPI: Arbor? "12–25 ped. alt.," gracilis cum radicibus aereis; *foliis* 1.29 m. longis 6.2 cm. latis prope basi sed 3–7 cm. latis prope medio longe acuminatis circa 10 cm. ex apice 6 mm. latis firmis valde fibrosis marginibus in basi inermibus sed in tertia infera armatis dentibus 2–3 mm. longis subulatis brunneo-cacumenatis adscendentibus 2–13 mm. distantibus sed in tertia medialis in uno latere inermibus et in altero latere cum dentibus simulantibus 9–17 mm. distantibus sed in parte apicali dentibus adscendentibus 0.2–0.5 mm. longis 3–7 mm. distantibus, nervo medio inermi, *inflorescentia* foeminea solitaria et terminali (?), pedunculo 19 cm. longo 7–12 mm. diametro trigono, bracteis numerosis foliosis ad 95 cm. longis 10–14 mm. latis longe acuminatis et subulatis, syncarpio 10 cm. longo 7.5 cm. diametro ovoideo obtuse subtrigono, *drupis* 2.5–2.8 cm. longis 1.2–1.3 cm. latis 1 cm. diametro in basi 5–10 mm. latis, corpore anguste obovoideo coloribus incognitis in sicco epidermatibus exfoliatis fibris longitudinalibus numerosis nudatis, caverna apicali parte cum tubera brunnea cumpleta, stigmate 2 mm. lata anguste lunata excentrale in margine sentinae apicale, endocarpio minime submediale osseoso obscure brunneo muris externis 1.5 mm. crassis, seminibus 7 × 5.5 mm., mesocarpio apicalis caverno singulo, mesocarpio basilari carnoso et valide fibroso.

DESCRIPTION OF ALL SPECIMENS EXAMINED: Tree, "erect, 12–25 ft. high," slender and with prop roots; *leaves* 1.27–1.29 m. long, 6.2 cm. wide near the base, 3.7–6.1 cm. wide near the middle, long tapering to a slender, narrowing tip, the actual tip (probably about 3 cm. long and 2 mm. wide) is missing, and at about 10 cm. from the tip it is only 6 mm. wide, texture firm, with strong fibrous veins; the margins unarmed for the lower 8 cm., on the lower third the margins with ascending brown-tipped, subulate teeth 2–3 mm. long, 2–13 mm. apart, at the middle unarmed on one margin, but on the other with similar teeth, appressed and 9–17 mm. apart, near the apex the teeth ascending, 0.2–0.5 mm. long, 3–7 mm. apart, midrib unarmed; *pistillate inflorescence* single and apparently terminal; peduncle 19–20.5 cm. long, 7–12 mm. in diameter, trigonous, with numerous leafy bracts up to 95 cm. long, 10–14 mm. wide, long tapering to a subulate tip; *syncarp* 10 cm. long, 7.5 cm. in diameter, ovoid, obtusely subtrigonous, drupes about 140, crowded, the upper ¼ exposed; *drupes* 2.5–2.8 cm. long, 1.2–1.3 cm. wide, 1 cm. thick, the base 5–10 mm. wide, the body narrowly obovoid, color not recorded, on drying the smooth epidermis exfoliating and exposing the numerous longitudinal fibers, apical concavity partly filled by a darker brown, pillow-

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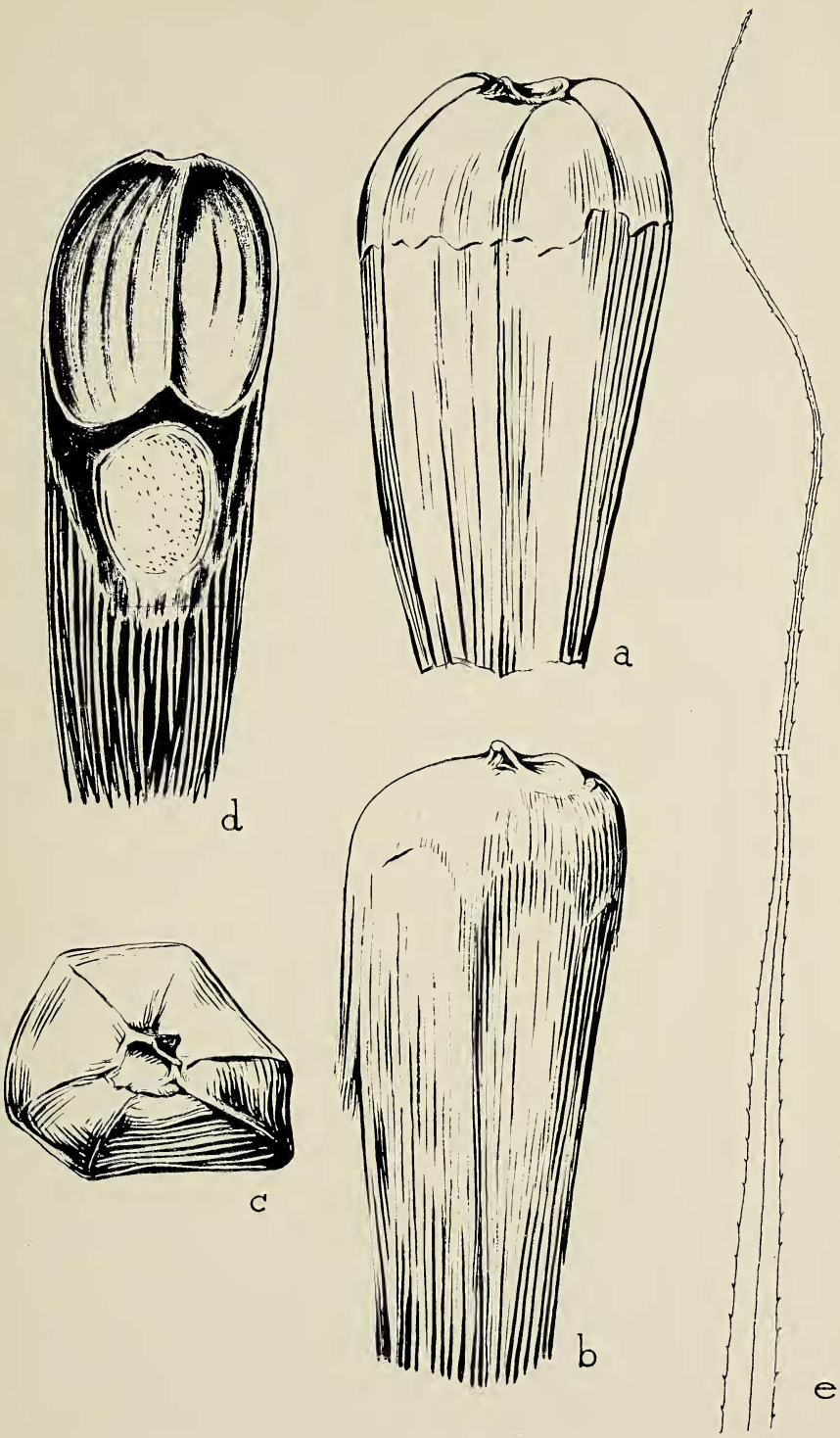

Fig. 9. *Pandanus kimberleyanus* St. John, from holotype. *a, b, c, d,* Drupe × 2⅔; *e,* leaf tip × ⅔.

like swelling; stigma 2 mm. wide, narrow lunate, on the margin of the concavity, excentric; endocarp slightly submedian, dark brown, bony, the outer wall 1.5 mm. thick; seed cavity 7 × 5.5 mm.; apical mesocarp one large cavity; basal mesocarp fleshy and strongly fibrous; *staminate inflorescence* leafy bracts almost unarmed; tip of inflorescence 4.5 cm. long, lateral spikes 1.5–2.5 cm. long; staminal columns 4–7 mm. long, stout, antheriferous in upper third, bearing about 7 anthers, free filament tips 0.3–1.3 mm. long; anthers 1.8–2 mm. long, 0.3 mm. wide, narrowly oblong, the base subsagittate, the apex apiculate.

HOLOTYPUS: Western Australia, West Kimberley, Fitzroy River, Aug. 1906, *W. V. Fitzgerald 2,395,* fruiting specimen, (NSW).

SPECIMENS EXAMINED: Western Australia, West Kimberley, mixed with the holotype, but a staminate inflorescence (NSW); Denham River, Oct. 1906, *W. V. Fitzgerald 1,625* (PERTH).

DISCUSSION: The specimens here described as new have been identified as *P. aquaticus* F. Muell., which species was first published by von Mueller in 1856 as a provisional species. Later, in 1865, he accepted and validated it with a description which included no more than that the plants were small and slender, lacked aerial roots, and had separate drupes. Bentham received from von Mueller only leaves and a staminate inflorescence, so could not fully document the species. Warburg saw no more and considered the species dubious. Martelli mentioned no specimens but listed the species. Blake (1954: 131) considered it to be the same as, and an earlier name for, *P. de-Lestangii.* The type locality of *P. aquaticus* was upper Victoria River, Northern Territory, and that of *P. de-Lestangii* Martelli was Burketown, n. w. Queensland. Blake considered that there was only one such species in northern Australia, reduced *P. de-Lestangii* to synonymy, and accepted *P. aquaticus* as the correct name. The present writer found in the Melbourne herbarium *P. aquaticus* F. Muell., from upper Victoria River, Dec. 1955, F. v. Mueller. The specimen consists of only a single leaf. It seems to be the holotype or an isotype. The one at Kew is little better, and the description was inadequate. After much field experience, it is realized that numerous species may grow side by side, and that geographic proximity of collections is not enough basis for reducing taxa to synonymy in this genus. It seems better to concur with Bentham and with Warburg and to continue to place *P. aquaticus* F. Muell. with the imperfectly known species. *P. de-Lestangii* Martelli was adequately described and illustrated from fruiting material, and staminate material is also known. This species is known to occur from the Daly River, Northern Territory, to the Gregory River, northwest Queensland. Fitzgerald (1918: 110) treated this species as *P. aquaticus* in his check list. Besides the two localities from which specimens were seen, he also gave the additional localities: Isdell, Charnley, and King River.

P. de-Lestangii Martelli, of the section *Microstigma,* has drupes 3.5–4.3 mm. long, stigmas apical, oblique, suborbicular, 1–3 in number; syncarp 10–13 cm. in diameter; leaves 4.5–8 cm. wide. *P. kimberleyanus,* of the same section, has drupes 2.5–2.8 cm. long; stigma narrowly lunate, excentric on the margin of the apical concavity; and leaves 3.7 cm. wide.

The new specific epithet is a geographic adjective, made from the name of the well-known Kimberley district where the plant occurs.

Pandanus convexus sp. nov. (sect. *Pandanus*)
Fig. 10

DIAGNOSIS HOLOTYPI: Arbor 10 m. altus, *phalangibus* (unam vidi) 6.3 cm. longis 6.6 cm. latis 5.2 cm. crassis late cuneatis in basi truncatis, lateribus planis levibus lucidis parte tertia superiore libera, sinibus lateralibus inter carpellas plerumque tam longis quam parte libera, angulis lateralibus minoribus et paucis, apice alto-convexa, carpellis 8, apicibus carpellarum depresso-convexis, sinibus centralibus 1.5–3 mm. profundis, stigmatibus 4–5 mm. longis subcentralibus suborbicularibus centripetalibus cordatis horizontalibus, endocarpio submediali 47 mm. longo 54 mm. lato magno obscure brunneo osseoso, seminibus 16–17 mm. longis 4–4.5 mm. diametro ellipsoideo, mesocarpio apicali cum cavernis parvis remotis medullosis et cum fibris, mesocarpio basali minimi fibrosi et carnosi.

DESCRIPTION OF ALL SPECIMENS EXAMINED: Tree 10 m. tall; trunks usually several together,

bi- tri-furcated near the summit; leaves 1.7 m. long, 6.7 cm. wide, lance-ligulate, long tapering; the marginal teeth at base few and small; the median teeth 2–4 mm. long, 5–12 mm. apart, acicular, appressed ascending, the larger ones red brown at tip; the teeth near the apex 0.2–1 mm. long, 5–12 mm. apart; midrib below with strong, retrorse prickles 3–4 mm. long, 12–25 mm. apart, red brown; *syncarps* "6–9 in. in diam., globular, red," *phalanges* 5.9–6.3 cm. long, 6.6–7.9 cm. wide, 5.2–7.6 cm. thick, "red," broad cuneate, the base truncate, the sides plane, smooth, shining, upper ⅓ free, the lateral sutures between the carpels as long as or shorter than the upper free part, lateral angles few and low, apex high convex; carpels 8–9, each apex low convex and with a radial suture line from the sinus to the stigma; inner sinuses 1.5–3 mm. deep; stigmas 4–5 mm. long, nearly central, suborbicular cordate, horizontal, flush, centripetal; endocarp slightly submedian, 47 mm. long, 54 mm. wide, massive, bony, dark brown; seeds 16–17 mm. long, 4–4.5 mm. in diameter, ellipsoid; apical mesocarp with small remote caverns which have longitudinal fibers and pithy cross partitions; basal mesocarp very small, fibrous and fleshy; *staminate inflorescence* 15.5 cm. long, 3 cm. diam., compact ellipsoid, with bracts 3–6 dm. long, 2–2.5 cm. wide, foliaceous, the margins entire; lateral spikes 1.5–3 cm. long, dense; stamens racemose; *anthers* 4.5–6 mm. long, linear sagittate, acuminate.

HOLOTYPUS: Western Australia, Dillens Springs, Oct. 1906, *W. V. Fitzgerald 2,394* (SYD).

SPECIMENS EXAMINED: Western Australia, Dillens Springs, Oct. 1906, *W. V. Fitzgerald 2.394* (the staminate inflorescence mixed with the holotype) (SYD).

Northern Territory: Escape Cliffs, *Hulls* [an error for *W. Hulse*] (Mel).

DISCUSSION: This species is known from meager collections, but it seems amply distinct by its phalanges with 8–9 carpels, small remote

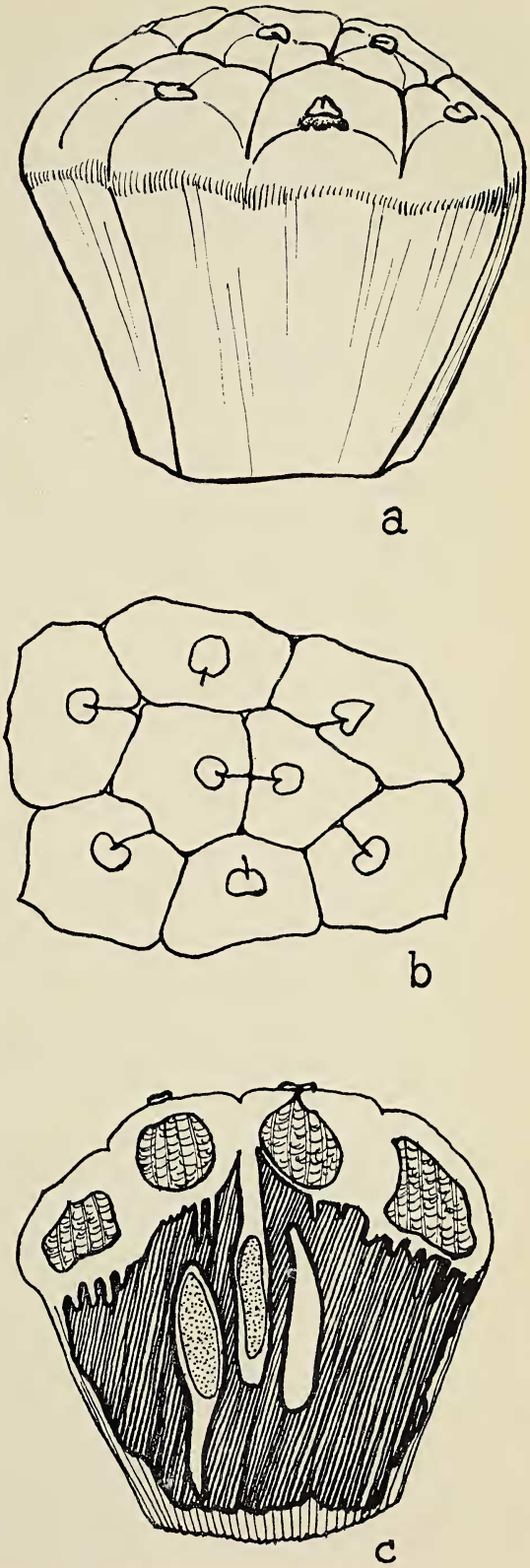

FIG. 10. *Pandanus convexus* St. John, from holotype. *a*, *b*, *c*, Phalange × 1.

apical mesocarp caverns, and the massive endocarp filling 5/6 of the interior. The related *P. spiralis* R. Br., described from the Wellesley Group, Gulf of Carpentaria, Queensland, has the phalanges with 16–22 carpels, the apical mesocarp caverns contiguous and ¼ as long as the phalange; and the endocarp ½ as long as the phalange and consisting of narrow, mostly separate bands.

The type locality is listed by Fitzgerald (1918: 220) as Dillen's Springs, spelled with an apostrophe. The locality is about 47 mi. south of Wyndham in East Kimberley and at approximately 16° S., 128° E.

The collector of the specimen from Escape Cliffs was published by Bentham (1878: 149) as Hulls. This was an error. The collector's name was really W. Hulse, as indicated by F. von Mueller (1869: 20).

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NOTES ON THE SECTION FOULLIOYA

In the preceding Part 1, the section Foullioya Warb. was listed but was omitted from the key. It should be inserted as follows, on p. 3, replace the second D, by:

D. Stigmas narrower than apex of drupe,
  a. Stigmas lunate, lateral under a horizontal coriaceous, entire or lobed visor borne asymmetrically on the apical region of the drupe but not marginal; syncarp solitary, cylindric, enwrapped in boat-shaped colored bracts; staminate flowers unknown ..... *Maysops*
  a. Stigmas deeply 2-lobed, tonguelike or reniform and 2-lobed, terminal, ascendings arcuate; syncarps several, globose to broad ellipsoid, with a single bract, exposed; stamens few, fascicled at apex of column ..... *Foullioya*

The genus *Fouilloya* Gaud., when published in 1841, contained illustrations of the two following species:

First, *F. maritima* Gaud. It was suggested by Brongniart (Ann. Sci. Nat. Bot. VI, 1: 291, 1875), that the type of this came from Madagascar or Mauritius. Later, Vaughan and Wiehe (Linn. Soc. Bot. J. 55: 20, 1953), report no living species on Mauritius that agrees with it and no evidence that it previously existed there. It has not been rediscovered elsewhere, but all its close relatives are native to Madagascar. It was renamed *Pandanus maritimus* Solms (1878), but this is a later homonym of *P. maritimus* Thouars (1808). So, this species has not been rediscovered since its publication in 1841, its homeland is unknown, and the specific epithet is unavailable in *Pandanus*.

Second, *F. racemosa* Gaud. Solely upon this was founded *Pandanus racemosus* Kurz (1869). It has not been rediscovered, and is known only from the Gaudichaud illustration and his specimen. Its homeland is unknown, but its relatives occur in Madagascar.

The group was first validly published as the section *Foullioya* (as *Fouilloya*) by Warburg

(1900), emend. Pic.-Ser. (1951). He included and accepted the two species first announced by Gaudichaud (1841) and added the two following:

P. Boivini Solms (1878) was described from a staminate flowering specimen, collected in Madagascar. The pistillate material for this species has not yet been discovered.

P. pygmaeus Thouars (1808), a Madagascar species represented by several recent collections, and by illustrations.

In choosing a lectotype one would normally prefer one of the two species that Gaudichaud included when he originally published the group as a genus. But, both of these are known only by the figures of the fruit given by Gaudichaud and by his scanty type specimens at Paris, and their nativity is unknown. Either of them would be unsatisfactory as a type. Consequently, depending on the fact that the genus when published by Gaudichaud was bitypic, and was without description, and was thus invalid, it is permissible to bypass them. Of the four original species in the valid section *Foullioya* Warb. emend. Pic.-Ser., only one is well known, of known origin, and still extant. Consequently this species is here chosen as, lectotype: *P. pygmaeus* Thouars.

Errata

The drawings for St. John's "Revision of the Genus *Pandanus* Stickman, Part 1," which appeared in Pacific Science 14(3): 224–241, were reduced to sizes which did not agree with the measures indicated in the legends.

Newly-written legends, which correct the errors, are presented herewith.

FIG. 1. *Pandanus biakensis*, from the holotype. *a*, Leaf base underside, × 5/11; *b*, leaf base margin, × 1.8; *c*, leaf middle underside, × 5/11; *d*, leaf tip underside, × 5/11; *e*, phalange, lateral view, × 5/11; *f*, phalange, longitudinal median section, × 5/11; *g*, phalange apex, × 1.8.

FIG. 6. *Pandanus conicus*, holotype. *a*, Phalange, lateral view, × ¾; *b*, phalange, longitudinal median section, × ¾; *c*, phalange, apical view, × ¾; *d*, carpel apices and stigmas, an inner one at lower right, and three outer ones, oblique view, × 3; *e*, leaf base, lower side, × ¾; *f*, leaf middle, lower side, × ¾; *g*, leaf tip, lower side, × ¾; *h*, leaf tip, lateral view, × ¾; *i*, leaf tip, lateral view, × 3.

FIG. 7. *Pandanus cochleatus*, from holotype. *a*, Phalange, lateral view, × ¾; *b*, phalange, longitudinal median section, × ¾; *c*, phalange, apical view, × ¾; *d*, carpel apices and stigmas, an inner one at left, and two outer ones, oblique view, × 3; *e*, leaf base, lower side, × ¾; *f*, leaf middle, lower side, × ¾; *g*, leaf margin at middle, × 3; *h*, leaf apex, lower side, × ¾.

FIG. 8. *Pandanus Zea*, holotype. *a*, Younger syncarp, × 3/14; *b*, mature syncarp, × 3/14; *c*, lateral drupes from above, × ¾; *d,e*, lateral drupes, from above, × 3; *f*, lateral drupe from side, × 3; *g*, lateral drupe from side, × ¾; *h*, lateral drupe from side, × 3; *i*, lateral drupe, longitudinal median section, × 3; *j*, apical drupes, from above, × ¾; *k,l*, apical drupes, from above, × 3; *m*, apical drupe, oblique lateral view, × 3; *n*, apical drupe, lateral view, × ¾; *o*, apical drupe, lateral view, × 3; *p*, apical drupe, longitudinal median section, × 3; *q*, leaf base, lower side, × ¾; *r*, leaf middle, lower side, × ¾; *s*, leaf apex, lower side, × ¾.